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Suicide Prevention

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Abstract

Suicide is a public health problem affecting people across the lifespan. It is currently the 10th leading cause of death, with rates having remained relatively flat for the past century. This article summarizes the problem of suicide and suicidal behavior along with suicide prevention efforts in the United States. Part 1 provides an overview of the epidemiology of suicide, including groups most at risk of suicide and suicidal behavior. Part 2 provides a review of common risk factors, organized by developmental life stage. A brief discussion of the lesser well-researched area of protective factors follows. Part 3 provides an overview of suicide prevention today, including the major types of prevention strategies, their successes, including means restriction, quality improvement in behavioral services, and comprehensive programs; and limitations to date, such as a lack of evidence for impact on actual deaths or behavior, small sample sizes, and low base rates. Finally, part 4 discusses challenges and future directions with an eye toward the great many opportunities that exist for prevention.

Keywords

self-directed; violence; public health; prevention; preventive medicine; suicide

Part I: Overview

Suicide presents a major challenge to public health in the United States and around the world. In the United States, suicide has ranked among the top 12 leading causes of death since 1975.[1] In 2009, the number of deaths from suicide reached an unfortunate milestone and surpassed the number of deaths from motor vehicle crashes.[2] According to the most recent data, in 2011, suicide s, and in the past 45 years, suicide rates have increased worldwide by 60%.[5]

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Authors' Note

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

As big a problem as suicide is, millions more people make suicide attempts and struggle with suicidal thoughts. In 2012, according to data from a national sample of emergency departments, nearly 484 000 (rate: 157/100 000) people visited emergency departments for self-harm injuries.*,6 In 2008, 1.1 million US adults (1%) self-reported a suicide attempt in the past year. Of this group,

> Unofficial estimates suggest that for every suicide, there are 4 attempts among elderly people, 25 attempts among adults, and from 100 to 200 attempts among young people.

claimed the lives of 39 518 people (rate: 12.3/100 000) and was the tenth leading cause of death overall.[3] This equates to 1 death from suicide every 13.3 minutes. The picture around the world shows a pervasive burden, with an overall rate of 11.4/100 000 in 2012. According to the World Health Organization (WHO), suicide is the 15th leading cause of death globally for all ages, with 803,900 deaths per year (rate: 11.4/100 000).[4] This equates to 1 death from suicide every 4062.3% received medical treatment and 46% were admitted to hospital. In the same year, 8.3 million adults reported serious thoughts of suicide (3.7%).[7] According to a nationally representative sample of high school students, in 2013, 8% of students self-reported having attempted suicide, and 17% seriously considered suicide in the past 12 months.[8] Unofficial estimates suggest that for every suicide, there are 4 attempts among elderly people, 25 attempts among adults, and from 100 to 200 attempts among young people.[9,10]

Suicides, attempts, and ideation take an immense emotional, physical, and economic toll on individuals, families, and communities, inclusive of our health care system, schools, workplaces, places of worship, and beyond. By one estimate, for every death by suicide, 6 people are directly affected (ie, survivors). Based on this figure, there are an estimated 13 million survivors in the United State,[11] and unfortunately, survivorship itself is a risk factor for suicide.[12] This article will discuss the precursors to suicide, populations most affected, the state of suicide prevention, and successes and challenges, followed by a discussion of future directions and recommendations.

Epidemiology: Mortality

Age- and Sex-Specific Suicide Rates.—Men typically comprise about 80% of all suicides; however, women outnumber men in suicide attempts by about 3:2.[3] Whereas suicide prevention efforts typically focus on youth and older adults, trends in suicide rates over time depict increasing rates in the middle-age group, that is, 35 to 64 years.[13] Over the decade 1999 to 2010, rates among this group increased by nearly 30%, from 13.7/100 000 to 17.6/100 000. The bulk of this increase occurred in the age group 50 to 59 years, which saw an increase of nearly 50%, from 20.5/100 000 in 1999 to 30.4/100 000 in 2010. Among women, rates increased nearly 60% among 60- to 64-year-olds, from 4.4/100 000 in 1999 to 7.0/100 000. Contributors to this increase may include the economic downturn because historically, the suicide rate tends to correlate with business cycles,[14] a cohort effect among

*Most self-harm is thought to be related to suicide attempts. The remainder is considered nonsuicidal self-injury (NSSI); however, we know from the research that NSSI is a risk factor for suicide.

the “baby-boomer” generation,1[15] and a rise in intentional overdoses associated with increased availability of prescription opioids.[13] Further research is needed to examine the increase in a more in depth manner.

Among people 10 to 34 years old, suicide rates changed very little over the decade 1999 to 2010: 9.2/100 000 in 1999 to 9.9/100 000 in 2010, $p < .06$. Historically, older adults have had the highest rates of suicide. However, among older adults >65 years old, rates decreased, though not significantly, from 15.8/100 000 in 1999 to 14.9/100 000 in 2010; $p < .09$.[13] In 2010, this group represented 13% of the US population but accounted for 15.6% of all suicides.[10] *Race-/Ethnicity-Specific Suicide Rates, 1999–2010.* Rates of suicide vary dramatically by race/ethnicity across the life course. For example, among those 15 to 24 years old, in 2011, the rate of suicide among non-Hispanic, American Indian/Alaska Natives (AI/AN) was 17.7/100 000 versus 12.0/100 000 among non-Hispanic whites, and suicide was the eighth leading cause of death among AI/ AN of all ages. Rates among non-Hispanic blacks, non-Hispanic Asian-Pacific Islanders (A/PI), and Hispanic youth were roughly 6/100 000 in 2011. After the age of 24 years, rates of suicide generally decrease among AI/AN and black, non-Hispanics but increase among whites, who account for the large majority of suicides: 90% in 2011. Among A/PI and Hispanics, rates decrease after 24 years and then remain fairly level until late life, when they increase again. In each of the racial and ethnic groups, suicide rates were higher for men than for women.[3,16]

Method of Suicide.—Firearms account for half of all suicides in the United States, but rates vary by sex, race/ethnicity, and age. Men use firearms more than half of the time (56%), followed by suffocation (26%) and poisoning (11%). Women are more likely to die from poisoning (37%), followed by firearms (31%) and suffocation (23%). In 2011, firearms were the leading method of suicide among whites (53.1%) and blacks (49.1%). Among Hispanics (43.4%), A/PI (48.5%), and AI/AN (43.9%), suffocation was the leading method.[3] Among the middle-age group, 35 to 64 years old, the largest increase between 1999 and 2010 took place among suffocation suicides (predominantly hanging).[13] This is troubling, given the challenges to reducing access to this method, except among confined populations. Some facilities are restricting access through a comprehensive strategy, including training, assessment, identification, safe housing, and monitoring.[17] Among youth 15 to 24 years old, firearms were the leading cause of suicide (45.0%) in 2011, followed by suffocation (39.4%). Among older adults >65 years old, firearms account for more than 71% of suicides.[3]

Geographical Variation.—In 2011, age-adjusted suicide rates varied substantially across states, from 23.2 per 100 000 population in Wyoming to 6.8 in the District of Columbia.[3] As in previous decades, age-adjusted suicide rates were the lowest in the northeast (9.8 per 100 000) and highest in the southern (12.9) and western (13.9) states. When state-specific age-adjusted suicide rates for the United States were ranked from highest to lowest, 9 of the top 10 states were located in the western region.[*],10 Reasons for differences in rates by region are unknown but hypothesized to be a result of variations in population density because low-

[*]Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and

density areas (i.e., rural) are associated with greater access to firearms, more social isolation, greater distance to life-saving treatment, and vvalues that may enforce individualism and self-reliance versus help-seeking.[18] A CDC study found that regional variation in suicide was not explained by race, ethnicity, sex, or age differences.[19]

Epidemiology: Morbidity

As stated, the number of suicides reflects only a small portion of the impact of suicidal behavior overall. Many more people are hospitalized for nonfatal suicidal behavior than are fatally injured, and an even greater number are treated in ambulatory settings or are not treated at all.[8] Only within the past 20 years have nationally representative statistics been available for suicidal thoughts and behavior among persons in the United States.

The National Electronic Injury Surveillance System developed by the US Consumer Product Safety Commission was expanded in July 2000 to collect data on all types of nonfatal injuries treated in a nationally representative sample of US hospital emergency departments. In 2012, 483 596 people received care in emergency departments for nonfatal self-harm injuries (rate: 157.4/100 000), including 286 367 women (rate: 188.1/100 000) and 197 229 men (rate: 127.8/100 000). Overall, self-inflicted injury rates were highest among adolescents and young adults. The majority (54.9%) of all self-harm injuries are related to poisoning. Adults >65 years old and older contribute a much smaller proportion to the suicide morbidity burden, with a rate of self-harm injuries seen in the emergency department of 28.1/100 000 versus 173.9/100 000 in the population younger than 65 years.[3] The reason for this disparity is that older adults typically use highly lethal means to attempt suicide and, therefore, have a high case fatality rate. They also tend to be more isolated and less likely to be rescued in an attempt.[20]

Economic Burden

Using 2005 suicide data and cost estimates, including medical and work loss costs, CDC estimated a combined cost of $55 billion.[21] In 2011, the United States experienced 789 580 years of potential life lost.[3] Compounding these costs are the unquantifiable costs that result from emotional trauma experienced by surviving family, friends, and communities.[11]

Part II: Risk and Protective Factor Research

Risk Factors

Suicide and suicidal behavior are complex problems and are not caused by one factor but rather influenced by multiple factors acting at multiple levels—individual, family, community, and societal—over time.[22] Contributors of suicide include biological, psychological, and social factors acting more proximally to the individual and cultural, political, and economic issues operating more distally. Some of these factors, more specifically, include the following: the presence of a mental health disorder such as mood disorders, substance abuse, personality disorders, history of suicide attempts, physical

Wisconsin. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

illness, pain, and socioeconomic issues (eg, area poverty level and unemployment)[23]; family problems such as child maltreatment or history of suicide; relationship problems such as bullying, intimate partner problems, and social isolation; and societal problems such as easy access to lethal means and stigma associated with mental illness and help seeking.[22] Much of the information about risk factors for suicide comes from psychological autopsy studies, retrospective analyses of the characteristics, backgrounds, and circumstances of people who die by suicide.[24] These studies have advantages such as being very in depth and disadvantages such as relying on key informants who may not be reliable sources of information. Some risks vary by age, gender, and culture, whereas others are more universal.

Children/Youth.—Suicide in children, particularly prior to puberty is a rare event. Researchers believe that this is related to the fact that 2 of the most common risk factors, depression and exposure to drugs and alcohol, do not typically occur until adolescence.[25] However, some children of a very young age do die by suicide and may know what they are doing.[26] Some research suggests that it is a lack of fear about physical pain and death that enables the behavior. Indeed, in one small case-control study, researchers found that compared with nonsuicidal psychiatric inpatient comparisons, suicidal children had greater pain tolerance and engaged in more aggressive behavior. They also had more depression and were more likely to be abused or neglected compared with matched nonsuicidal peers.[26]

Adolescents and Young Adults.—Adolescence is a time of growth characterized by biological, psychological, and social changes. It often includes risk taking and testing and pushing of boundaries as a means of seeking greater independence. One's level of success navigating adolescence affects the transition into young adulthood when new job and family responsibilities take precedence.[27] Suicide is uncommon in early adolescence. In 2011, suicide was the third leading cause of death among youth 10 to 14 years old and the second leading cause of death for people 15 to 24 years old. Rates varied significantly: 1.36/100 000 among 10- to 14-year-olds, 8.32/100 000 among 15- to 19-year-olds, and 13.63/100 000 among 20- to 24-year- olds.[3] In 2011, more teenagers and young adults died from suicide than from cancer, heart disease, AIDS, birth defects, stroke, pneumonia and influenza, and chronic lung disease combined.[3]. Risk factors for suicide during adolescence and young adulthood include the following: mental illness, prior suicide attempts, hopelessness, family history of suicidal behavior, parental divorce, child maltreatment, school problems, suicide of a peer, poor problem-solving ability, easy access to lethal means, conduct disorder in male youth, troubled relationships with parents, and peer victimization.[28–32]

Special Population: Active Duty Military/Veterans

Suicide is a health issue among active duty military and veterans. In 2010, suicide was the second leading cause of death among US service members, exceeded only by war injury.[33] Factors including relationship discord, legal/ disciplinary problems, financial difficulties, and health problems are thought to play a role.[34] Other risk factors include sexual violence[35] and a history of childhood trauma.[36] Though the US Air Force has reported success in reducing suicide rates, the effectiveness of military prevention programs has been difficult to measure.[37,38]

The Department of Defense funds the Millennium Cohort Study,[39] and National Institutes of Health and the US Army fund the Army Study to Assess Risk and Resilience in Servicemembers, known as Army STARRS.[40] The former found that mental disorders such as depression and alcohol use disorders were associated with suicide. An unexpected finding was that suicide was not associated with deployment (ie, combat, duration of combat, and number of deployments were not risk factors).[41] Results from Army STARRS suggest that suicide rates increased the most among the currently and previously deployed in the period 2004–2009 but also increased among the never deployed.[42] The Department of Veterans Affairs (VA) developed data systems to increase understanding of suicide among veterans and inform the VA suicide prevention programs.[43] As a result of these activities, the VA was able to establish that the risk of suicide among veterans of the Vietnam War or the 1991 Gulf War, as a whole, was not significantly higher than that among nondeployed veterans or the general US population. They determined that, historically, the rates of suicide among veterans in general were lower than that of the US population, but the recent increased risk of suicide observed among Operation Enduring Freedom/Operation Iraqi Freedom (Iraq and Afghanistan wars) veterans when compared with the US population,[44] even though not statistically significant, warrants attention.

Middle-aged Adults.—Middle adulthood challenges may include changes in marriage, job plateaus or shifts, children leaving home, caring for an aging parent, and change in one's own health status, such as onset of chronic illness.[45,46] Less is known about the unique suicide- related risk factors among this age group because much of the research on suicidal behavior has focused on youth and older adults.[47] However, some risk factors include relationship problems, financial and/or job problems, alcoholism, depression, lack of connectedness, and legal difficulties.[14,47,48] Suicide rates among working-age adults 25 to 64 years old have tended to increase during recessions and fall during times of economic expansions.[14] Social norms may also play out most in this age group, with men being less likely than women to seek help for mental health and other stressors, preferring instead to handle problems on their own.[49,50] This may include self-medicating with drugs and alcohol. If men do seek out medical care, it is typically for physical health symptoms.[50] See Lapierre et al[51] for recommendations for increasing treatment seeking among men. The social and personal costs associated with suicide in middle age are tremendous. For example, there are lost contributions to families, lost work productivity, interrupted childrearing, and disrupted marriages.

Older Adults.—Older adulthood may be characterized as a time of more predictable and stable emotions; however, social roles and networks change, as does physical functioning.[52] Among older adults, physical illness, loss, and mental illness are common risk factors in suicide. In a review of the research, between 71% and 95% of older adult suicides involved a mental health condition, most notably depression.[53]

Although certain physical conditions have been found to be associated with suicide, including cancer and heart, and lung diseases, a more important factor may be the number of ailments versus specific types of illnesses.[54] Still other studies indicate that it is not the objective physical health condition that matters so much as the subjective sense of one's

health.[55,56] Another important risk factor for elders is a lack of social connectedness to family, friends, and community.[20] Practically speaking, fewer people in one's social network may indicate a lower likelihood of intervention or rescue, if an attempt is made.[53] A study dating back to 1971 found that older people dying by suicide were more likely to live alone compared with their peers in the community.[57] Also, access to lethal means and a greater intent to die are contributors to older adult suicide.[53] Recommendations for reaching older men include de-emphasizing the diagnosis of depression and accentuating the symptoms of depression and stress instead, thereby reducing shame and stigma associated with mental illness.[58] Additionally, more trained gatekeepers in the community where men interact may aid prevention.[51]

Protective Factors

Protective factors serve to buffer or reduce suicide risk. Protective factors may be characterized as biopsychosocial, environmental, or sociocultural. Biopsychosocial factors include, for example, genetics, personality and coping style, and interactions or relationships with others such as family and friends. Protective factor research in this area is most focused perhaps on psychological and social factors. For example, the Centers for Disease Control and Prevention identified enhanced connectedness as a strategic direction for suicide prevention.[59] Research suggests that connectedness to family, in particular, is effective at reducing suicide risk among youth.[60–61] Whitlock et al[64] provide a more detailed examination of connectedness pathways. Positive coping and conflict resolution skills are also associated with reduced suicidal behavior.[65] Among depressed adolescents, research suggests that the perception of problem-solving ability and attitude toward solving problems appear to be more important than self- reported ability in predicting risk of suicidality.[66] This has implications for prevention strategies designed to enhance protective factors. Environmental factors may include policies, services, or systems or may refer to physical aspects of one's surroundings. For example, reduced access to lethal means (eg, firearms pesticide, and medication) for vulnerable populations has consistently been shown to reduce suicide.[67–69] Easy access to quality clinical care[70]and insurance benefits for mental health commensurate with physical health coverage may also reduce suicide.[71] Sociocultural factors may include social norms, politics, or the economy. Research here has found religion, including attendance at religious services[72] and religious sanctions against suicide,[65,66] to be protective. Unfortunately, protective factor research pales in comparison to risk factor research; so much more is needed. For example, we stand to learn a good deal from groups where suicide rates are relatively low—for example, among certain racial/ethnic groups.[11]

Part III: Prevention Strategies

In 1996, the United Nations formulated official guidelines for national suicide prevention strategies that encouraged governments to take up comprehensive approaches to suicide prevention.[73] The United States along with a number of other countries responded. In 2012, the United States Office of the Surgeon General and National Action Alliance for Suicide prevention released the second *National Strategy for Suicide Prevention: Goals and Objectives for Action*.[186] This strategy takes a public health approach and, as such,

recommends the following: defining the problem of suicide through surveillance or systematic collection of morbidity (attempts) and mortality (suicide) data over time, identifying suicide risk and protective factors through research, developing and testing suicide prevention strategies, and ensuring widespread adoption of effective programs. Following the 1996 guidelines,[73] the Institute of Medicine published a report, *Reducing Suicide: A National Imperative*, that further organizes prevention programs and activities into 3 levels—universal, selective, and indicated—based on their focal population[74]:

- Universal (U) prevention addresses the entire population, such as a school, community, or state, regardless of the level of risk of individuals within that population. Interventions may include public education campaigns, awareness programs, means restriction laws, media guidelines, and policies for crisis response. The benefit of these programs is that they affect large numbers of people and may stem the tide of suicide if implemented before risk factors associated with suicide take hold. The downside is that the program may not meet the needs of people at higher risk, and effects often take a long time to observe.
- Selective (S) interventions address at-risk groups with the goal of preventing the onset of suicidal behavior. Strategies here include screening programs (eg, depression screening), training of community members to recognize and respond to at-risk individuals (ie, gatekeeper training), and skills or support groups. The benefit of such strategies is that they are relatively easy to implement. The downside is that their intended effects on suicide and help seeking are not always observed or measured.
- Indicated (I) interventions address individuals deemed *high risk* by virtue of a prior suicide attempt or suicidal ideation. Strategies in this category may include care management for individuals discharged from inpatient facilities, psychiatric treatment, and cognitive- behavioral skills groups. The benefit to these strategies is that they are tailored to individuals. The downside is that they do not address the root of the problem of suicide in the population.

For maximum reach and impact, states and communities may consider adopting a set of universal, selective, and indicated strategies to create a comprehensive or integrated approach to prevention.74 In doing so, communities can stem the onset of suicidal behavior while simultaneously caring for individuals in need of treatment and follow-up. The following provides information on universal, selective, and indicated strategies as reported in the peer- reviewed literature, typically from meta-analyses and systematic reviews. For additional strategies not included, the reader may consult the Substance Abuse and Mental Health Services Administration's (SAMHSA) National Registry of Evidence-based Programs and Practices (http://nrepp.samhsa.gov/) and the Best Practice's Registry (http://www.sprc.org/bpr), also funded by SAMHSA.

Universal Strategies

Public Education Initiatives.—The first goal of the 2001 National Strategy for Suicide Prevention reads "Promote awareness that suicide is a public health problem that is

preventable."[22] (p. 44) Public education initiatives are a popular way to do this. They typically seek to raise awareness in the population about suicide and its risk and protective factors, dispel myths related to suicide, change attitudes and social norms around help seeking, increase mental health literacy, and reduce stigma toward mental illness.[75–77] These interventions may take the form of billboards; signs on public transportation; public service announcements via television, radio, or the Internet; and brochures and/or other traditional print materials. Campaigns may be short, single-exposure events or longer term, with greater exposure. The target population may be very general or more targeted—for instance, toward health care providers. A review of interventions targeting the general population found that many do increase knowledge and attitudes in the short term, particularly around depression and mental illness; however, the impact on help-seeking behavior, intention to seek care, or suicidal behavior, itself, is uncertain.[76] Related to suicide specifically, assessing changes in rates is difficult given the relative rarity of these events and the large population size needed to see an effect. Two campaigns that did assess actual suicide rates over time found no significant reductions[78,79]; however, the latter did report a significant change in number of suicide attempts.

In reviewing 14 community-based suicide prevention psychoeducational campaigns, Fountoulakis et al[75] found that these campaigns improved knowledge and attitudes; however, campaigns often failed to impact actual behavior. Campaigns also often failed to reach the targeted group. In some cases, treatment seeking actually decreased in those with depression or suicidal ideation, indicating that these groups require more tailored prevention messages.[75,77,80] A total of 7 studies reported reduced suicide rates[81–87]; 5 studies took place among Japanese elders with results largely confined to women.[81–85] Recommendations include highlighting prevention, positive action, and effective treatments and providing information on warning signs, risk factors, and protective factors. Things to avoid include normalizing suicide—for example, making it appear as a common solution to every-day stressors—or glorifying suicide.[88]

Positive effects of campaigns have been associated with multipronged strategies (eg, media plus gatekeeper training), highly targeted campaigns in local areas, repeat exposure, and clear and specific messaging.[76] Assessing the needs of the population and the cultural context prior to implementation is important as is the need to consider specific indicators for evaluation purposes (eg, "How will attitudes be measured, over what period of time, and for how long?") Other considerations include having a sound theoretical basis for the intervention and cost-effectiveness.[76]

Media Reporting.—Media accounts of suicide may have a positive or negative impact on behavior. A danger of media reporting is suicide contagion—the process by which one suicide facilitates the occurrence of a subsequent suicide— and should be avoided by taking care not to normalize or glorify suicide, present suicide as a common reaction to stress, or give detailed information about the means of suicide.[89,90] In an effort to prevent contagion, the WHO and partners in the US formulated guidelines for the media on safe reporting.[91] Little evaluation of such guidelines has taken place. However, an Austrian study focused on improved reporting of subway suicides showed significant success in the 4 years following the guidelines. Overall, suicides decreased by 20%, and subway suicides, specifically,

decreased by 75%. Moreover, no substitution of suicide methods (eg, use of firearms in suicide versus subways) was found.[92]

School-Based Awareness Education and Curricula.—School-based awareness programs are a common prevention strategy across the United States. They typically seek to increase knowledge of suicide risk factors and warning signs, change attitudes about mental illness and help seeking, provide helping resources, and teach ways to respond to an at-risk peer.[93] A recent review of school-based studies, using a range of study designs and taking place between 1988 and 2011, identified 15 universal prevention programs. Programs ranged from a single session to sessions lasting up to 12 weeks.[94] The 6 studies that measured suicide ideation, attempts, and/or plans all found reductions in at least 1 suicide-related outcome. Additionally, 9 of 9 studies found improvements in knowledge, whereas 7 of 11 studies found improvements in attitudes. Another 6 of 11 studies found significant improvements in help-seeking self- efficacy. Another study not identified in the above review implemented a district-wide comprehensive program inclusive of curricula, policies, and teacher training. Over the course of 5 years, student suicides and suicide attempts in the district significantly declined.[95] Unfortunately, no comparison group was included.

Two more recent programs utilizing a randomized controlled trial design, *Sources of Strength*[96] and the *Good Behavior Game*,[97] also found positive effects. The former, a high school–based program designed to enhance protective factors among peer leaders and students, reported increased adaptive norms regarding suicide, connectedness to adults, school engagement, referral of a suicidal friend to an adult, perceptions of adult support, and acceptability of seeking help.[96] The latter, a classroom- based program for children in the first and second grades designed to reduce aggression and disruptive behavior found longitudinal effects on suicide ideation and attempts among 19- to 21-year-olds; however, in some covariate-adjusted models, the effect of the intervention on attempts did not remain significant.[97] This result holds promise for future programs focused “upstream” in childhood, with impacts over time.

A 2009 study examined 8 methodological features of school-based programs: measurement, comparison group, outcomes, educational/clinical significance, identifiable components, implementation fidelity, replication, and site of implementation. It found only weak to promising evidence based on these features, indicating that more work needs to be done to improve study quality.[98] Related to this, recommendations for school-based programs include assessing long-term knowledge, attitude, and skill-building outcomes; linking help-seeking to suicidal behavior; measuring suicidal behavior preintervention and postintervention; using common measures across programs; examining moderating variables such as gender; accounting for nesting of students within schools in analyses; considering individual versus environmental-level change targets; and emphasizing social support and school connectedness.[93,98] A word of caution: at least 1 program found that youth who made a prior suicide attempt were more likely to report a negative reaction to a school-based prevention program than their peers without an attempt history.[99] However, a more recent study found no iatrogenic effects in a school-based suicide prevention screening program,[100] though more research on the topic is recommended.[94]

Restricting Access to Lethal Means.—Limiting access to lethal means of suicide is an intervention with robust supporting evidence.[101] These interventions can typically be implemented quickly and measured relatively easily compared to other more complex approaches—for example, interventions seeking to change social norms.[67] Studies find reduced suicide rates associated with restricted access to firearms among high-risk groups,[102,103] paracetamol (ie, Tylenol),[104] other medications,[105] toxic gas,[106] pesticides,[107] ligature points in institutional settings,[108,109] and high places such as bridges.110 Moreover, restricted access often did not lead to total substitution of methods, and in cases of substitution, the case-fatality rate of substituted methods was generally lower than the original method, leading to lower suicide rates overall.[111,112] Restricting access to lethal means may be particularly effective in preventing highly lethal and impulsive suicides.[113,114] Long-term follow-up and assessment of confounding factors is recommended.[101]

Selective Strategies

Screening.—Screening interventions seek to identify people at risk of suicide, typically through a 2-step process— completion of a brief self-report instrument assessing risk factors, usually depression, followed by an in-depth face-to-face clinical interview where needed. Screening programs typically take place in schools or physicians' offices.

Research suggests that school-based screening identifies more at-risk people than the number identified by professionals,[115] and some programs have shown positive effects on decreased suicide attempt rates.[116] On the downside, school-based screening has been controversial,[117] including concerns that screening for suicide risk will actually increase risk of the very behavior. However, existing research does not bear this out.[100,118] Other downsides include the resource intensiveness of screening. For example, to identify all at-risk youth, a population-wide screening protocol is needed. This may stretch the capacity of mental health service personnel, who must follow up with each positively screened youth.[119] For example, a 2013 review identified 7 programs with available referral information. Across varied populations of different ages, races, and geographic locations, referral rates ranged from 4% to 45%.[94] Additionally, resources for staff training, while taking into account staff turnover, raise the issue of cost- effectiveness.[75,90,94] Screening programs receive less support from administrators and parents than other prevention activities such as curricula.[95,96] Some opponents suggest that screening programs are veiled attempts to encourage psychiatric treatment and others question the need for clinically recommended treatment.[120]

According to the latest US Preventive Services Task Force (USPSTF) recommendations, screening tools have limited ability to detect suicide risk in adolescents, and then only among high-risk adolescents, including psychiatric outpatients121 and potential high school dropouts.122,123 For adults, the USPSTF found evidence from 2 studies that screening tools can identify adults and older adults in primary care who are at increased risk of suicide, though many false positives were also identified.[124,125] For a review of instruments for use in primary care, see O'Connor et al.126 Overall, the USPSTF finds insufficient evidence for the balance of benefits and harms associated with screening for suicide risk in primary care.[127] However, the Task Force does recommend screening adults for depression "when staff-

assisted depression care supports are in place to assure accurate diagnosis, effective treatment, and follow-up."[128(p3)]

Gatekeeper Training.—Gatekeeper training teaches individuals how to identify and respond to people who may be at risk of suicide.[129] Gatekeeper training is modeled on the assumptions that people at risk do show signs, will not otherwise seek help, and that treatment will be sought and is effective.[129] A recent review article found 9 high-quality peer-reviewed studies of gatekeeper training, with 7 studies assessing changes in attitudes, knowledge, and skills. Study samples ranged in size from 44 community members to 602 US Veterans Administration workers. Among the studies, 6 showed unequivocal increases in knowledge; all increased skills, self-efficacy, or intentions to help; and those that assessed attitudes, also found positive effects. Also, 6 cohort studies examined the effects of training on suicidal ideation, attempts, or suicide over time.[129] These studies included physician education programs,[130] the US Air Force,[86] and programs for aboriginal youth.[131] All noted positive outcomes. The most notable and widely cited program was the US Air Force Suicide Prevention Program, a quasi- experimental cohort study with 11 components, including gatekeeper training. Compared with the 1990–1996 cohort, the 1997–2002 cohort experienced a 33% reduction in suicide along with reductions in homicide and moderate and severe family violence.[86] However, it is unclear whether these reductions related directly to the gatekeeper training.

Among school-based gatekeeper training programs, specifically, a 2013 review identified 12 gatekeeper training programs.[94] Of these, 9 found increased knowledge from pretest to posttest or compared with controls; 2 of 5 studies reported improved attitudes; 7 studies assessed confidence in dealing with suicide-related behavior or mental health issues; and all reported increases from pretest to posttest or compared with controls. Finally, only 5 of 12 studies assessed actual behavior change, defined broadly from capability of or actually inquiring about suicidal ideation, making no-harm contracts, change in practice, help seeking, using coping resources, to identifying trusted adults. All found positive effects, though 1 study did not find an effect of training on identification of communication with at-risk students.[132]

Although the United Nations[73] and others[22] recommend gatekeeper training as part of a comprehensive suicide prevention program, evidence is limited as to its effectiveness across populations over time, and many programs have yet to demonstrate changes in outcomes related to actual rates of help seeking and subsequent ideation, attempts, and suicide.[129] Research indicates that gatekeeper training may be most useful in smaller communities where treatment resources are readily available and where tracking of the intervention is easier; however, this also raises the issue of privacy and confidentiality.[101]

Primary Care Education.—Education for primary care providers is a subset of gatekeeper training and related to screening. It teaches physicians how to identify and treat at-risk individuals. This intervention is particularly important given the research that mental illness is underrecognized and undertreated in primary care settings[133] and given previous research findings that more than 75% of those who committed suicide sought contact with a primary care doctor or non–mental health care provider in the month prior to their deaths.

[134,135] A 2011 review of older adult suicide prevention programs identified 2 primary care interventions: Prevention of Suicide in Primary Care Elderly Collaborative Trial and Improving Mood: Promoting Access to Collaborative Treatment. The former trained physicians to identify and treat older adults with depression and to connect them to care managers for follow-up. The latter intervention included development of a therapeutic alliance, a personalized treatment plan, and follow-up by a depression care manager. Both studies found lower rates of depression and suicide ideation in the experimental group compared with care as usual (CAU).[136,137] International studies have also found increased prescription rates for antidepressants after physician education programs and reductions in actual suicides[138]; however, the impact was greatest among female patients.[130,139]

Behavioral Health Systems Improvement.—Suicide in the context of behavioral health is a risk for patients with depression and other psychiatric disorders. In 2001, the Behavioral Health Services division of Henry Ford Health System implemented a quality improvement program known as “Perfect Depression Care.” This model relied on suicide assessment for all behavioral health patients and 6 strategies for health care improvement: safety, effectiveness, patient centeredness, timeliness, efficiency, and equity. Some of the specific strategies included means restriction for patients, provider education, patient follow-up via phone calls, and patient peer support services.[140] Between baseline and follow-up, a period of 11 years, suicides dropped by 82%.[141] Efforts are underway to expand this approach in other organizations and settings with in an initiative called “Zero Suicide.” More information is available at www.zerosuicide.actionallianceforsuicideprevention.org

Indicated Strategies

Clinical Interventions.—Though it is estimated that a majority of people who die by suicide suffer from mental disorders,[142] studies also indicate that the vast majority of individuals diagnosed with mental disorders, including clinical depression, do not die by suicide but from other causes.[143,144] However, treating mood and other psychiatric disorders can be a useful component of suicide prevention.

Pharmacotherapy.—Antidepressant medications have been shown to alleviate depression and other psychiatric disorders; however, meta- analyses of randomized controlled trials, generally, have not detected benefit for suicide or suicide attempts.[145,146] Although concern exists over the risk of suicide with antidepressants, Gibbons and Mann[147] suggest that among adults, it is inadequate treatment (psychotherapy or pharmacotherapy) that is the culprit. For example, a cohort study in the Netherlands (n = 1667) found that among primary care patients with moderate to severe major depressive disorder or anxiety, 70% and 60%, respectively, were not treated sufficiently (eg, too low a dose) with pharmacotherapy or psychological treatment.[148] Among youth, more study is needed to determine who may be most helped by medications. One study, the Treatment for Adolescent Depression Study, found that fluoxetine alone or in combination with cognitive behavior therapy (CBT) did reduce depression and suicidal behavior.[149] Positive effects have also been found for lithium. A meta-analysis of 48 randomized controlled trials comparing lithium with a placebo or other active comparators among people with unipolar or bipolar disorder found decreased rates of suicide in the lithium group.[150] Lithium is hypothesized to prevent relapse of mood

disorders and to reduce aggression and impulsivity.[150] Evidence also exists for an antisuicidal effect for clozapine in schizophrenia; however, the drug includes 5 black box warnings and requires intensive monitoring.[151]

Psychotherapy.—A recent review of psychotherapy trials conducted among high-risk adults found a 32% reduction in the likelihood of suicide attempts or deliberate self-harm compared with CAU. Among 9 trials conducted with high-risk adolescents, psychotherapy did not reduce attempts at 6 to 18 months of follow-up compared with CAU, and no beneficial effects were found for suicidal ideation beyond CAU.[123] Another recent review article examining randomized controlled trials of interventions for prevention of repeat adolescent self- harm suggested that the studies with the strongest effect on suicide attempts were integrated CBT and mentalization-based therapy. Each had a family component and provided a large number of individual sessions.[152]

Brief Interventions for Follow-up Care.—People who make a suicide attempt are at increased risk of repeat attempts, particularly in the period soon after hospitalization.[153,154] To prevent this, follow-up programs seek to help people maintain medication compliance, keep follow-up appointments, and provide support. Interventions have included simple referrals, written communication, phone contacts, or home visits with patients after inpatient hospitalization or emergency room visits for self-harm. With regard to suicidal behavior, specifically, research indicates that postcards sent to patients showing concern and inquiring about treatment follow-up did reduce suicidality; however, as the contact was reduced, the protective effect also decreased.[155] Another intervention targeting patients seen in an emergency department for intentional self-poisoning, utilized telephone follow-up after 1 and 3 months. The group that received 1-month follow-up calls had lower rates of repeat attempts compared with a control group that received no contact, and the group that received 3-month follow-ups only postdischarge did not differ from the control group.[156] Finally, an international study in several low- and middle-income countries utilized an hour-long informational video at the emergency department coupled with 9 follow-up phone calls and found decreased suicides after 18 months postdischarge compared with treatment as usual.[157] No differences in repeat suicide attempts were found[158] (see new technology for information on text messaging).

Skills Building Groups.—Skills building groups typically help promote emotion regulation, coping ability, and conflict resolution; use CBT; and are led by trained clinicians. These programs may take place in outpatient or inpatient settings or in schools. The most widely recognized and evaluated CBT program focused on preventing suicide ideation and attempts is Dialectic Behavior Therapy (DBT). Studies of DBT have found reduced ideation, attempts, and self-injury among reductions in other problem behaviors in both adults and adolescents.[159,160] Among school programs, Project CAST (Coping and Support Training) showed sustained increases in problem-solving coping and personal control compared with a less-intensive program, C-CARE (Counselors CARE). CAST also reduced alcohol and marijuana use.[161] Neither program, however, reduced actual suicide or attempts, but this was likely related to a lack of statistical power.

Hotlines and Crisis Centers.—Suicide and crisis hotlines are one of the oldest suicide prevention interventions in the United States.[162] Impact of these resources on actual suicide rates have been examined using large ecological studies comparing the suicide rates in areas with and without a crisis program or in areas before and after the introduction of a crisis program. No significant differences in suicide rates in areas with crisis centers were observed in 7 of 14 studies; however, a meta- analysis found some overall preventive effect.[163] Weak effects were noted in a more recent study examining the correlation between crisis center density and suicide rates in Canada.[164] A 2007 evaluation of more proximal indicators of suicide, from a subset of the National Suicide Prevention Lifeline centers, indicated significant decreases in suicidality during the course of the telephone session, with continuing decreases in hopelessness and psychological pain in the following weeks. A caller's intent to die at the end of the call was the most potent predictor of subsequent suicidality.[165] Further evaluation of the National Suicide Prevention Lifeline is ongoing.

Postvention.—Having a friend or acquaintance attempt suicide is significantly associated with a peer's suicide ideation and behavior.[166] *Postvention* is the term used to describe interventions that occur in response to a suicide, typically with the goal of preventing additional suicides or containing a potential suicide cluster. Postvention may take place with members of a family or community, such as a city, school, or workplace. In a recent review, 16 studies met inclusion criteria for quality and effectiveness. No program found evidence of a protective effect for prevention of suicide or suicide attempts; however, gatekeeper training increased knowledge of crisis intervention among school personnel; outreach at the scene of suicide encouraged survivors to attend a support group and seek help in dealing with their loss; and contact with a counselor helped reduce psychological distress in the short term.[167]

In a review of postvention strategies following a suicide cluster, researchers found 5 published studies that identified 6 main approaches to postvention: development of a community response plan; educational/psychological debriefings; individual and group counseling to affected peers; screening of high-risk individuals; responsible media reporting of the suicide cluster; and promotion of health recovery within the community to prevent future suicides. The studies did not evaluate the overall effectiveness of different strategies.[168] Among those bereaved by suicide, recommendations include the need for larger and better-controlled studies along with the need to assess bereavement groups for suicide survivors versus other groups.[169]

Integrated and Comprehensive Approaches

The most well-known program that had positive effects on rates of suicide and other violent outcomes is the US Air Force Suicide Prevention Program, which included 11 different components and included all personnel (discussed above).[86] Another example of a comprehensive program is the American Indian Natural Helper program, which found significantly reduced suicide attempts, both medically serious and nonmedically serious, in the community over time.[170] National, state, and local strategies for suicide prevention also typically provide a comprehensive array of approaches for prevention. Although these strategies may be difficult to evaluate, at least one country has attempted to do so: Australia.[171] The Valuing Young Lives comprehensive strategy includes 88 components. The

evaluation reported improved capacity building among service systems, expanded training resources, and increased awareness, but no data were available related to actual improvements in the well-being of young people, including changes in suicide risk and protective factors.[171]

New Technology for Suicide Prevention

Many programs have emerged over recent years taking advantage of new technology. These programs include virtual gatekeeper training, crisis support through online chat, and telemedicine/ telepsychiatry.[172] Two studies utilizing text messages in place of postcard outreach with postattempt survivors found positive feedback from patients. These studies were small and need further investigation but show promise, given the ability to tailor messages, acceptability, and low cost.[173,174] In addition, the Internet has spawned a host of online prevention education, webinars, social networks, and communities of practice. Support groups have also formed over the Internet on Facebook and other social media sites. Social media[175,176] and Internet browsers[177] are also being used to track rates of suicide, suicide attempts, and risk factors. The success of these newer methods is widely unknown, though some programs have already populated sections I and II of the Best Practices Registry. The downside is that technology has also provided a platform for suicide education (ie, “how-to” methods and potential contagion[175]) and cyberbullying.[178]

Part IV: Challenges and Future Directions

Rates of suicide increased over the past decade. News stories telling of suicides among active military and veterans, bullied youth, professional sports players, and celebrities, appear almost daily, yet suicide prevention efforts remain limited, particularly in comparison to other public health problems with fewer deaths (eg, hypertension, HIV/AIDS, Parkinson’s disease). Why is this so and what can be done to reverse these trends?

The original National Strategy for Suicide Prevention listed improved timeliness and usefulness of national surveillance systems related to suicide as one of its goals.[22] The CDC is taking steps to reach this goal. For example, it continues to expand the number of states participating in the National Violent Death Reporting System (NVDRS) nationwide. The NVDRS is a large-scale surveillance system that captures details on a variety of violent deaths, including suicides. Specifically, it collects information on decedent characteristics, the mechanism of death, and known precipitating circumstances. Data for each case are linked and come from death certificates, medical examiner/ coroner reports, law enforcement, and toxicology reports. As more states become part of NVDRS, our understanding of factors contributing to suicide will improve and will, in turn, help inform prevention research, policy, and practice. Other necessary improvements include more accessible and detailed data on suicide attempts. Currently, official data include self-harm incidents seen in the emergency department, but data are classified without regard to suicidal intent, and claims data are often incompletely classified.[179] Because of this, along with issues of stigma and privacy concerns, the burden of the problem of suicide attempts is underestimated.[74]

Suicide researchers are in the unenviable position of having to show impact of interventions on an outcome with a low base rate. For example, to show a 15% reduced rate of repeat suicide attempts, given a 2.8% chance over 8 years, would require 45 000 participants.[180] Although nobody is wishing for increased rates of suicide, funders want to see impact, and they want to see it in the short term. This would be difficult enough, but add to this concerns by institutional review boards about including suicidal people in clinical trials, and the problem increases.[181] It is no wonder that programs remain short term, unevaluated, and isolated from other related programmatic areas (eg, violence prevention). One remedy is to pool data from multiple sites to increase sample size and the ability to detect an effect.[182]

Currently, many people view prevention of suicide as solely a mental health endeavor or responsibility, yet little research exists showing effectiveness of mental health treatment for suicide prevention. Furthermore, although people with depression have a 50 times greater rate of suicide than the general population, we still have no way of predicting who will die.[183] To compound the issue, treatment does not reach all who need it, and for those whom it does reach, it may not be adequate. A survey of people in 21 nationally representative samples found that 40% of suicidal people had received treatment, ranging from 17% in low- income countries to 56% in high-income countries.[184] Among those who received treatment, there is evidence to suggest undertreatment.[185] Given this scenario, the National Strategy for Suicide Prevention recommends a broader public health approach that addresses multiple risk and protective factors.[186]

Finally, where programs and treatments have been found to be effective, there is little widespread implementation and adoption given the limited resources for suicide prevention. Enhancement of implementation entails a well-trained suicide prevention workforce, a program of research guided by clearly defined goals and programmatic gaps, along with a sustained commitment to action, particularly as related to upstream approaches that may take months if not years to show impact.

Despite the challenges, there is some good news related to surveillance, evidence-based practices, theory development, stigma reduction, resources, policy advances, and broad partnerships with renewed commitment. As mentioned above, efforts to reduce lag time in reporting of mortality data is under way.[187] Systems such as NVDRS are providing more information about suicides than ever before, as evidenced by success stories[188] and publications.[189,190] We have seen evidence of suicide reductions in clinical care. Training primary care doctors to recognize and treat depression has been found to be effective among older adults and among men. Changing media reporting practices has shown reduced rates of suicide by train in Vienna. Creating barriers on bridges, switching to catalytic converters, detoxifying domestic gas, and reformulating and locking up pesticides have all reduced the rates of suicide at home and abroad. Community-based programs such as that implemented by the Air Force brought down rates of suicide and other violent deaths; dialectical behavior therapy, lithium, postcard interventions, and chains-of-care, all have some evidence to suggest that they can reduce rates of suicidal behavior among those at high risk.

Ways of thinking about suicide, both scientifically and in the general population, have seen advances. For example, new theory has emerged, including Joiner’s oft-cited Interpersonal

Theory of Suicide[191] and O'Connor's Integrated Motivational-Volitional Model of Suicidal Behaviour.[192] Connectedness and related constructs, such as social support, social networks, and belongingness have become nearly universal in studies and surveys[193–195] and on health-related Web sites[196] and blogs.[197] Though more work is needed to improve attitudes about people with mental illness, mental health literacy and attitudes toward help seeking for mental illness have improved.[198]

Commitment to suicide prevention at the national level has also expanded. Funding by the Departments of Defense has increased exponentially,[40] and President Obama's budget requests to Congress for FY14 and FY15 recommended $10 million for gun violence research and increased funding for the national implementation of NVDRS. Additionally, the 2008 Mental Health Parity and Addiction Equity Act[199] is set to be fully carried out. Finally, in 2012, the National Action Alliance for Suicide Prevention, a broad public- private partnership, led a renewed effort for suicide prevention in the United States through shepherding of the National Strategy for Suicide Prevention.[186] The Action Alliance also created a prioritized national research agenda to substantially reduce the burden of suicide.[200]

Finally, other once seemingly intractable problems have found a home in public health prevention, including motor vehicle crashes, HIV/AIDS, and smoking. Public health interventions addressing these problems took years to take hold and overcame immense stigma and political opponents. Suicide can do the same.

What We Can Do

There is much that we, as health professionals and as a society can do to prevent suicide. First, we can widely promote the message that suicide is preventable and work to reduce stigma associated with mental illness and help seeking. Although many prevention efforts currently do this, more can be done to change prevailing attitudes that if someone is suicidal there is nothing to be done.[201] In reality, the urge to die is often impulsive and short lived.[202,203] We can strive to change social norms, systems (eg, separation of mental and physical health care systems), practices (eg, screening, patient-provider interfaces), and policies concerning help seeking, particularly among males.204 We may expand engagement with at-risk and high-risk populations in the community (eg, the criminal/legal system, schools, substance abuse treatment centers) and not expect that they will show up in doctors' offices. We may reach out and ensure inclusion of survivors and those with lived experience in all suicide prevention efforts and work to bring others into the fold to take up advocacy and investment in suicide prevention in both the public (local, state, and federal levels) and private sectors. The public health and mental health communities can continue to engage in coordinated and collaborative efforts along with researchers in violence and unintentional injury (eg, prescription drug overdose). Other partners may include those groups with a focus on connectedness, such as chronic disease researchers, where social support has long been reported to affect mortality.[205] According to De Leo et al,[206] increasing protective factors may do more to prevent suicide than decreasing risk factors. The private sector, most notably the workplace, is a partner that has historically been less involved; however, we know that millions of dollars are lost each year as a result of absenteeism and presenteeism

(ie, being at work but not being productive because of distraction) related to depression[207] and mental illness, let alone suicide and suicidal behavior. Medical providers and hospice workers can also play a role in improving pain management and palliative care; faith- based communities can help decrease stigma and promote help seeking; and police and first responders have an important role in knowing how best to identify and respond to at-risk individuals, as do practitioners working with juveniles and incarcerated populations.

Methodologically, we may benefit from improved data collection, including coordinating surveys, improving measures, and making boiler plate language easily available for IRBs when issues or concerns arise related to fears of liability or iatrogenic effects of interventions and surveys. To combat the low-base-rate dilemma, researchers recommend the dynamic-waitlist and multitrial follow-up[208] study design to increase power. Greater attention to factors more distal to suicide (eg, child maltreatment, parental mental illness) or what is known as the population approach is critical to stemming the tide of new cases of suicide.[183] We know that a whole host of adverse childhood experiences are associated with suicide attempts.[209] Preventing these events from occurring may ultimately reduce suicide, especially in the context of other improvements. Related to this, improving the social determinants of health may also help improve outcomes of suicide and associated risk factors—for example, employment and education opportunities.[14,110] Finally, doing more to promote what's worked and encouraging innovation through new technology is recommended.[211] Together, with full knowledge, cooperation, and good science and clinical care, we can reverse the tide of suicide and raise the health and well-being of all.

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